

$\Omega^-$ 

$$I(J^P) = 0(\frac{3}{2}^+) \text{ Status: } ***$$

The unambiguous discovery in both production and decay was by BARNES 64. The quantum numbers follow from the assignment of the particle to the baryon decuplet. DEUTSCHMANN 78 and BAUBILLIER 78 rule out  $J = 1/2$  and find consistency with  $J = 3/2$ . AUBERT,BE 06 finds from the decay angular distributions of  $\Xi_c^0 \rightarrow \Omega^- K^+$  and  $\Omega_c^0 \rightarrow \Omega^- K^+$  that  $J = 3/2$ ; this depends on the spins of the  $\Xi_c^0$  and  $\Omega_c^0$  being  $J = 1/2$ , their supposed values.

We have omitted some results that have been superseded by later experiments. See our earlier editions.

NODE=S024

## $\Omega^-$ MASS

The fit assumes the  $\Omega^-$  and  $\bar{\Omega}^+$  masses are the same, and averages them together.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1672.45±0.29 OUR FIT</b>				
<b>1672.43±0.32 OUR AVERAGE</b>				
1673 ± 1	100	HARTOUNI	85	SPEC 80–280 GeV $K_L^0 C$
1673.0 ± 0.8	41	BAUBILLIER	78	HBC 8.25 GeV/c $K^- p$
1671.7 ± 0.6	27	HEMINGWAY	78	HBC 4.2 GeV/c $K^- p$
1673.4 ± 1.7	4	<sup>1</sup> DIBIANCA	75	DBC 4.9 GeV/c $K^- d$
1673.3 ± 1.0	3	PALMER	68	HBC $K^- p$ 4.6, 5 GeV/c
1671.8 ± 0.8	3	SCHULTZ	68	HBC $K^- p$ 5.5 GeV/c
1674.2 ± 1.6	5	SCOTTER	68	HBC $K^- p$ 6 GeV/c
1672.1 ± 1.0	1	<sup>2</sup> FRY	55	EMUL
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1671.43±0.78	13	<sup>3</sup> DEUTSCH...	73	HBC $K^- p$ 10 GeV/c
1671.9 ± 1.2	6	<sup>3</sup> SPETH	69	HBC See DEUTSCHMANN 73
1673.0 ± 8.0	1	ABRAMS	64	HBC $\rightarrow \Xi^- \pi^0$
1670.6 ± 1.0	1	<sup>2</sup> FRY	55B	EMUL
1615	1	<sup>4</sup> EISENBERG	54	EMUL

<sup>1</sup>DIBIANCA 75 gives a mass for each event. We quote the average.

<sup>2</sup>The FRY 55 and FRY 55B events were identified as  $\Omega^-$  by ALVAREZ 73. The masses assume decay to  $\Lambda K^-$  at rest. For FRY 55B, decay from an atomic orbit could Doppler shift the  $K^-$  energy and the resulting  $\Omega^-$  mass by several MeV. This shift is negligible for FRY 55 because the  $\Omega$  decay is approximately perpendicular to its orbital velocity, as is known because the  $\Lambda$  strikes the nucleus (L.Alvarez, private communication 1973). We have calculated the error assuming that the orbital n is 4 or larger.

<sup>3</sup>Excluded from the average; the  $\Omega^-$  lifetimes measured by the experiments differ significantly from other measurements.

<sup>4</sup>The EISENBERG 54 mass was calculated for decay in flight. ALVAREZ 73 has shown that the  $\Omega$  interacted with an Ag nucleus to give  $K^- \Xi \text{Ag}$ .

NODE=S024M

NODE=S024M

NODE=S024M

## $\bar{\Omega}^+$ MASS

The fit assumes the  $\Omega^-$  and  $\bar{\Omega}^+$  masses are the same, and averages them together.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1672.45±0.29 OUR FIT</b>				
<b>1672.5 ± 0.7 OUR AVERAGE</b>				
1672 ± 1	72	HARTOUNI	85	SPEC 80–280 GeV $K_L^0 C$
1673.1 ± 1.0	1	FIRESTONE	71B	HBC 12 GeV/c $K^+ d$

NODE=S024M;LINKAGE=D

NODE=S024M;LINKAGE=F

NODE=S024M;LINKAGE=B

NODE=S024M;LINKAGE=E

NODE=S024MB

NODE=S024MB

NODE=S024MB

$$(m_{\Omega^-} - m_{\bar{\Omega}^+}) / m_{\Omega^-}$$

A test of  $CPT$  invariance.

VALUE	DOCUMENT ID	TECN	COMMENT
<b>(-1.44±7.98) × 10<sup>-5</sup></b>	CHAN	98	E756 $p$ Be, 800 GeV

NODE=S024DMM

NODE=S024DMM

NODE=S024DMM

## $\Omega^-$ MEAN LIFE

Measurements with an error  $> 0.1 \times 10^{-10}$  s have been omitted. The fit assumes the  $\Omega^-$  and  $\bar{\Omega}^+$  mean lives are the same, and averages them together.

VALUE ( $10^{-10}$ s)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.821±0.011 OUR FIT</b>				
<b>0.821±0.011 OUR AVERAGE</b>				
0.817±0.013±0.018	6934	CHAN	98	E756 $p$ Be, 800 GeV
0.811±0.037	1096	LUK	88	SPEC $p$ Be 400 GeV
0.823±0.013	12k	BOURQUIN	84	SPEC SPS hyperon beam
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.822±0.028	2437	BOURQUIN	79B	SPEC See BOURQUIN 84

NODE=S024T

NODE=S024T

## $\bar{\Omega}^+$ MEAN LIFE

The fit assumes the  $\Omega^-$  and  $\bar{\Omega}^+$  mean lives are the same, and averages them together.

VALUE ( $10^{-10}$ s)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.821±0.011 OUR FIT</b>				
<b>0.823±0.031±0.022</b>	1801	CHAN	98	E756 $p$ Be, 800 GeV

NODE=S024TA

NODE=S024TA

NODE=S024TA

$$(\tau_{\Omega^-} - \tau_{\bar{\Omega}^+}) / \tau_{\Omega^-}$$

A test of *CPT* invariance. Our calculation, from the averages in the preceding two data blocks.

VALUE	DOCUMENT ID
<b>0.00±0.05 OUR ESTIMATE</b>	

NODE=S024TD

NODE=S024TD

NODE=S024TD  
→ UNCHECKED ←

## $\Omega^-$ MAGNETIC MOMENT

VALUE ( $\mu_N$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>-2.02 ±0.05 OUR AVERAGE</b>				
-2.024±0.056	235k	WALLACE	95	SPEC $\Omega^-$ 300–550 GeV
-1.94 ± 0.17 ± 0.14	25k	DIEHL	91	SPEC Spin-transfer production

NODE=S024MM

NODE=S024MM

## $\Omega^-$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	
$\Gamma_1 \Lambda K^-$	(67.8±0.7) %		
$\Gamma_2 \Xi^0 \pi^-$	(23.6±0.7) %		
$\Gamma_3 \Xi^- \pi^0$	( 8.6±0.4) %		
$\Gamma_4 \Xi^- \pi^+ \pi^-$	( 3.7 <sup>+0.7</sup> <sub>-0.6</sub> ) × 10 <sup>-4</sup>		
$\Gamma_5 \Xi(1530)^0 \pi^-$	< 7 × 10 <sup>-5</sup>	90%	
$\Gamma_6 \Xi^0 e^- \bar{\nu}_e$	( 5.6±2.8) × 10 <sup>-3</sup>		
$\Gamma_7 \Xi^- \gamma$	< 4.6 × 10 <sup>-4</sup>	90%	

NODE=S024220;NODE=S024

DESIG=1

DESIG=2

DESIG=3

DESIG=8

DESIG=6

DESIG=7

DESIG=5

NODE=S024;CLUMP=A

DESIG=4

$\Gamma_8 \Lambda \pi^-$	$S2 < 2.9 \times 10^{-6}$	90%	
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NODE=S024225

NODE=S024225

## $\Omega^-$ BRANCHING RATIOS

The BOURQUIN 84 values (which include results of BOURQUIN 79B, a separate experiment) are much more accurate than any other results, and so the other results have been omitted.

$\Gamma(\Lambda K^-)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_1/\Gamma$
<b>0.678±0.007</b>	14k	BOURQUIN	84	SPEC SPS hyperon beam	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.686±0.013	1920	BOURQUIN	79B	SPEC See BOURQUIN 84	

NODE=S024R1

NODE=S024R1

$\Gamma(\Xi^0\pi^-)/\Gamma_{\text{total}}$ 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_2/\Gamma$
<b>0.236±0.007</b>	1947	BOURQUIN 84	SPEC	SPS hyperon beam	NODE=S024R2 NODE=S024R2
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.234±0.013	317	BOURQUIN 79B	SPEC	See BOURQUIN 84	

 $\Gamma(\Xi^-\pi^0)/\Gamma_{\text{total}}$ 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_3/\Gamma$
<b>0.086±0.004</b>	759	BOURQUIN 84	SPEC	SPS hyperon beam	NODE=S024R3 NODE=S024R3
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.080±0.008	145	BOURQUIN 79B	SPEC	See BOURQUIN 84	

 $\Gamma(\Xi^-\pi^+\pi^-)/\Gamma_{\text{total}}$ 

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_4/\Gamma$
<b>3.74<sup>+0.67</sup><sub>-0.56</sub></b>	100	5 KAMAEV	10	HYCP $p$ Cu, 800 GeV	NODE=S024R8 NODE=S024R8
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.3 <sup>+3.4</sup> <sub>-1.3</sub>	4	BOURQUIN 84	SPEC	SPS hyperon beam	

<sup>5</sup>This KAMAEV 10 value uses  $76 \Omega^- \rightarrow \Xi^-\pi^+\pi^-$  and  $24 \bar{\Omega}^+ \rightarrow \Xi^+\pi^-\pi^+$  decays. The  $\Omega^-$  and  $\bar{\Omega}^+$  branching fractions measurements are statistically equal. The errors given combine statistical and systematic contributions. The  $CP$  branching-fraction asymmetry,  $(\Omega^- - \bar{\Omega}^+)/\text{sum}$ , is  $+0.12 \pm 0.20$ .

 $\Gamma(\Xi(1530)^0\pi^-)/\Gamma_{\text{total}}$ 

VALUE (units $10^{-4}$ )	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_5/\Gamma$
<0.7	90		KAMAEV	10	HYCP $p$ Cu, 800 GeV	NODE=S024R6 NODE=S024R6
• • • We do not use the following data for averages, fits, limits, etc. • • •						
6.4 <sup>+5.1</sup> <sub>-2.0</sub>	4	6 BOURQUIN	84	SPEC	SPS hyperon beam	

<sup>6</sup>The same 4 events as in the previous mode, with the isospin factor to take into account  $\Xi(1530)^0 \rightarrow \Xi^0\pi^0$  decays included. BOURQUIN 84 adopted a theoretical assumption that  $\Xi(1530)^0\pi^-$  would dominate  $\Xi^-\pi^+\pi^-$  decay.

 $\Gamma(\Xi^0e^-\bar{\nu}_e)/\Gamma_{\text{total}}$ 

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_6/\Gamma$
<b>5.6±2.8</b>	14	BOURQUIN 84	SPEC	SPS hyperon beam	NODE=S024R7 NODE=S024R7
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~10	3	BOURQUIN 79B	SPEC	See BOURQUIN 84	

 $\Gamma(\Xi^-\gamma)/\Gamma_{\text{total}}$ 

VALUE (units $10^{-4}$ )	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_7/\Gamma$
< 4.6	90	0	ALBUQUERQ...94	E761	$\Omega^-$ 375 GeV	NODE=S024R5 NODE=S024R5
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<22	90	9	BOURQUIN 84	SPEC	SPS hyperon beam	
<31	90	0	BOURQUIN 79B	SPEC	See BOURQUIN 84	

 $\Gamma(\Lambda\pi^-)/\Gamma_{\text{total}}$ 

$\Delta S=2$ . Forbidden in first-order weak interaction.

VALUE (units $10^{-6}$ )	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_8/\Gamma$
< 2.9	90	WHITE 05	HYCP	$p$ Cu, 800 GeV	NODE=S024R4 NODE=S024R4 NODE=S024R4
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 190	90	BOURQUIN 84	SPEC	SPS hyperon beam	
<1300	90	BOURQUIN 79B	SPEC	See BOURQUIN 84	

 **$\Omega^-$  DECAY PARAMETERS** **$\alpha$  FOR  $\Omega^- \rightarrow \Lambda K^-$** 

Some early results have been omitted.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_2/\Gamma$
<b>0.0180±0.0024 OUR AVERAGE</b>					NODE=S024230
+0.0207±0.0051±0.0081					
+0.0178±0.0019±0.0016	960k	7 CHEN	05	HYCP $p$ Cu, 800 GeV	NODE=S024AL NODE=S024AL NODE=S024AL
-0.028 ± 0.047	4.5M	7 LU	05A	HYCP $p$ Cu, 800 GeV	
-0.034 ± 0.079	1743	LUK	88	SPEC $p$ Be 400 GeV	
-0.025 ± 0.028	12k	BOURQUIN	84	SPEC SPS hyperon beam	

<sup>7</sup>The results of CHEN 05 and LU 05A are from different experimental runs.

NODE=S024AL;LINKAGE=HY

**$\bar{\alpha}$  FOR  $\bar{\Omega}^+ \rightarrow \bar{\Lambda}K^+$** 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>-0.0181±0.0028±0.0026</b>	1.89M	LU	06	HYCP $p$ Cu, 800 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
+0.017 ± 0.077	1823	CHAN	98	E756 $p$ Be, 800 GeV

 **$(\alpha + \bar{\alpha})/(\alpha - \bar{\alpha})$  in  $\Omega^- \rightarrow \Lambda K^-, \bar{\Omega}^+ \rightarrow \bar{\Lambda}K^+$** 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>-0.016±0.092±0.089</b>	8 LU	06	HYCP $p$ Cu, 800 GeV

8 This value uses the results of CHEN 05, LU 05A, and LU 06.

 **$\alpha$  FOR  $\Omega^- \rightarrow \Xi^0 \pi^-$** 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>+0.09±0.14</b>	1630	BOURQUIN	84	SPEC SPS hyperon beam

 **$\alpha$  FOR  $\Omega^- \rightarrow \Xi^- \pi^0$** 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>+0.05±0.21</b>	614	BOURQUIN	84	SPEC SPS hyperon beam

NODE=S024ALA  
NODE=S024ALANODE=S024ALD  
NODE=S024ALD  
NODE=S024ALD

NODE=S024ALD;LINKAGE=LU

NODE=S024AX0  
NODE=S024AX0NODE=S024AX-  
NODE=S024AX-

NODE=S024

NODE=S024

 **$\Omega^-$  REFERENCES**

We have omitted some papers that have been superseded by later experiments. See our earlier editions.

KAMAEV	10	PL B693 236	O. Kamaev <i>et al.</i>	(FNAL HyperCP Collab.)	REFID=53427
AUBERT,BE	06	PRL 97 112001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51353
LU	06	PRL 96 242001	L.C. Lu <i>et al.</i>	(FNAL HyperCP Collab.)	REFID=51238
CHEN	05	PR D71 051102	Y.C. Chen <i>et al.</i>	(FNAL HyperCP Collab.)	REFID=50622
LU	05A	PL B617 11	L.C. Lu <i>et al.</i>	(FNAL HyperCP Collab.)	REFID=50614
WHITE	05	PRL 94 101804	C.G. White <i>et al.</i>	(FNAL HyperCP Collab.)	REFID=50583
CHAN	98	PR D58 072002	A.W. Chan <i>et al.</i>	(FNAL E756 Collab.)	REFID=46157
WALLACE	95	PRL 74 3732	N.B. Wallace <i>et al.</i>	(MINN, ARIZ, MICH+)	REFID=44203
ALBUQUERQ...	94	PR D50 R18	I.F. Albuquerque <i>et al.</i>	(FNAL E761 Collab.)	REFID=43862
DIEHL	91	PRL 67 804	H.T. Diehl <i>et al.</i>	(RUTG, FNAL, MICH+)	REFID=41505
LUK	88	PR D38 19	K.B. Luk <i>et al.</i>	(RUTG, WISC, MICH, MINN)	REFID=40447
HARTOUNI	85	PR L 54 628	E.P. Hartouni <i>et al.</i>	(COLU, ILL, FNAL)	REFID=12102
BOURQUIN	84	NP B241 1	M.H. Bourquin <i>et al.</i>	(BRIS, GEVA, HEIDP+)	REFID=12071
Also		PL 87B 297	M.H. Bourquin <i>et al.</i>	(BRIS, GEVA, HEIDP+)	REFID=12065
BOURQUIN	79B	PL 88B 192	M.H. Bourquin <i>et al.</i>	(BRIS, GEVA, HEIDP+)	REFID=12101
BAUBILLIER	78	PL 78B 342	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+) J	REFID=12095
DEUTSCH...	78	PL 73B 96	M. Deutschmann <i>et al.</i>	(AACH3, BERL, CERN+) J	REFID=12096
HEMINGWAY	78	NP B142 205	R.J. Hemingway <i>et al.</i>	(CERN, ZEEM, NIJM+)	REFID=12063
DIBIANCA	75	NP B98 137	F.A. Dibianca, R.J. Endorf	(CMU)	REFID=12062
ALVAREZ	73	PR D8 702	L.W. Alvarez	(LBL)	REFID=12092
DEUTSCH...	73	NP B61 102	M. Deutschmann <i>et al.</i>	(ABCLV Collab.)	REFID=12091
FIRESTONE	71B	PRL 26 410	I. Firestone <i>et al.</i>	(LRL)	REFID=12090
SPETH	69	PL 29B 252	R. Speth <i>et al.</i>	(AACH, BERL, CERN, LOIC+)	REFID=12089
PALMER	68	PL 26B 323	R.B. Palmer <i>et al.</i>	(BNL, SYRA)	REFID=12014
SCHULTZ	68	PR 168 1509	P.F. Schultz <i>et al.</i>	(ILL, ANL, NWES+)	REFID=12087
SCOTTER	68	PL 26B 474	D. Scotter <i>et al.</i>	(BIRM, GLAS, LOIC+)	REFID=12088
ABRAMS	64	PRL 13 670	G.S. Abrams <i>et al.</i>	(UMD, NRL)	REFID=12080
BARNES	64	PRL 12 204	V.E. Barnes <i>et al.</i>	(BNL)	REFID=12081
FRY	55	PR 97 1189	W.F. Fry, J. Schneps, M.S. Swami	(WISC)	REFID=12078
FRY	55B	NC 2 346	W.F. Fry, J. Schneps, M.S. Swami	(WISC)	REFID=12079
EISENBERG	54	PR 96 541	Y. Eisenberg	(CORN)	REFID=12077